

METHOD OF EFFACING ZIPPER IMAGE

BACKGROUND OF THE INVENTION

5 Field of the Invention

[0001] The invention relates in general to a method of effacing zipper image, and more particularly, to a method of effacing zipper image by approximating the gray scales of two neighboring pixels.

Description of the Related Art

10 [0002] Figure 1 shows a block diagram of a scanner having a stagger charge-coupled device. In Figure 1, the scanner 100 is coupled to a computer 150. The scanner comprises a stagger charge-coupled device 110 with a primary line and a secondary line, an application specific integrated circuit (ASIC) 120, an image compensation buffer 130 and an I/O interface 140.

15 [0003] When the scanner having the stagger charge-coupled device is scanning a document, the pitch between the primary line and the secondary line is small. The primary line is thus affected by the light reflected from the secondary line. Similarly, the secondary line is also affected by the light reflected from the primary line. A zipper image (as shown in Figure 3) in addition to a real image (as shown in Figure 2) is thus
20 produced by using the scanner with the stagger charge-coupled device to scan the document. When a document has a black-and-white boundary, the zipper image is more obvious, causing error in the actual image. Currently, a method to compensate the zipper image has not been found in the prior art.

SUMMARY OF THE INVENTION

[0004] The invention provides a method of effacing a zipper image by approximating the gray scales of two neighboring pixels.

[0005] The method of effacing the zipper image provided by the invention is applicable to scan a document using a scanner with a stagger charge-coupled device. The n th pixel obtained by scan on a scan line at which the zipper image is produced is subtracted by the $(n+1)$ th pixel obtained by scan on the scan line. The absolute value of the subtraction result is compared to a critical value. When the result is smaller than the critical value, the n th pixel is modified as the n th pixel after process. If the result is larger than the critical value, no process is performed.

[0006] The processed n th pixel is one half of the sum of the n th pixel obtained by scan and the $(n+1)$ th pixel obtained by scan.

[0007] In one embodiment of the present invention, the n th pixel after being processed is the sum of one half of the n th pixel obtained by scan and one half of the $(n+1)$ th pixel obtained by scan.

[0008] In one embodiment of the present invention, the critical value is a predetermined value or produced by a logic circuit. The critical value can be adjusted according to the modulation transfer function of the scanner with the stagger charge-coupled device.

[0009] Both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Figure 1 shows a block diagram of a scanner with a stagger charge-coupled device;

[0011] Figure 2 shows a real image of a document;

5 [0012] Figure 3 shows a zipper image produced by scanning the document using a scanner with a stagger charge-coupled device, and

[0013] Figure 4 shows a flow chart for a method of effacing a zipper image.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

10 [0014] Referring to Figure 1, a compensation operation is performed on a document before the document is scanned by a scanner 100 with a stagger charge-coupled device 110. Thereby, an image compensation parameter is obtained and stored in a computer 150. When the stagger charge-coupled device 110 performs the scan on any part of the document, an image compensation parameter corresponding to the
15 scanned part is retrieved from the computer 150 and transmitted to the image compensation buffer 130 via the I/O interface 140. The staggered scanned image obtained from the stagger scan by the stagger charge-coupled device 110 is then corrected by the ASIC 120 according to the image compensation parameter transmitted from the image compensation buffer 130. The corrected image is then transmitted to
20 the computer 150 via the I/O interface 140 for storage.

[0015] However, as the distance between the primary line and the secondary line is very short, the primary line is affected by the light reflected from the secondary line. Similarly, the secondary line is also affected by the light reflected from the primary line. A zipper image is thus produced to cause an error between the scanned image and the

real image.

[0016] Figure 4 shows a flow chart of effacing a zipper image according to the invention. In the following embodiment, a critical value used in the effacing process of the zipper image can be a predetermined value or a value generated by a logic circuit.

5 In Figure 4, assume that the n th (n is a positive integer) pixel obtained by scan on the scan line at which the zipper is produced is P_n , and the $(n+1)$ th pixel obtained by scan on the scanning line is P_{n+1} . The n th pixel being processed is referred as P_n' , and the critical value is denoted as T . In this embodiment, whether P_n subtracted by P_{n+1} is smaller than T is determined in step s400. When the absolute value of $|P_n - P_{n+1}|$ is

10 smaller than T , P_n is modified as P_n' . The value of P_n' can be expressed as $(P_n + P_{n+1})/2$ or $(1/2)P_n + (1/2)P_{n+1}$, as shown in step s410. The n th pixel after being processed as P_n' approximates the gray values of the n th and $(n+1)$ th pixel P_n and P_{n+1} obtained by scan, so that the zipper image can be effaced. When $|P_n - P_{n+1}|$ is larger than T , the effacing process is not performed.

15 [0017] The above embodiment compares two neighboring pixels at a scan line at which the zipper image is produced with a critical value as a reference for effacing process. If the effacing process is required, the gray values of these two neighboring pixels are approximated to each other to reduce the zipper image. However, the modulation transfer function of the scanner with the stagger charge-coupled device is

20 slightly reduced.

[0018] According to the above, the invention has the following advantages:

[0019] 1. Only a critical value is required to determine whether an effacing process is performed, thereby, two gray scales of two neighboring pixels are approximated to each other, and the zipper image is effaced.

[0020] 2. The fabrication cost is not increased.

[0021] Other embodiments of the invention will appear to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples to be considered as exemplary only, with
5 a true scope and spirit of the invention being indicated by the following claims.

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